July 21, 2004

TITLE: Overview of Proposed Monitoring Program to Determine Extent of WTC Impact

DISCLAIMER: This document is a draft for review and discussion purposes only. It has not been subjected to peer and administrative review and does not constitute U.S. Environmental Protection Agency policy. Mention of trade names or commercial products does not constitute endorsement or recommendations for use.

OBJECTIVES: Concurrent efforts have these objectives:
1 To estimate the geographic extent of WTC dust residues and COPC's by surveying residential and non-residential buildings in lower Manhattan that volunteer to participate. A subobjective will be to relate results of the survey to building cleaning history, if the information collected will support such an analysis.
2. To validate a method to identify a WTC signature in sampled dust

APPROACH:
Geographic Extent Survey

Overview of Design: The primary objectives of this survey will be to characterize buildings in the lower Manhattan area with regard to presence and concentrations of certain WTC contaminants of potential concern (COPCs) and to compare those findings with a "signature" for WTC dust residue. Based on results, a second phase of sampling may then extend into other areas. The intent is to characterize entire buildings by sampling a number of units within each building selected (see below for discussions of COPCs, signature COPCs, and units). The area of sampling extends throughout lower Manhattan to Houston Street, an area roughly double the size of the area included in the initial dust clean up program. The "target population" of buildings includes all "public" buildings and "private" buildings that volunteer to participate. Public buildings are defined as buildings which are occupied by public institutions, such as schools, firehouses, and buildings housing government offices. Private buildings include apartment buildings (public housing is included here along with private apartment building) and private office/commercial buildings. For purposes of the objectives stated above, these buildings can also be characterized with regard to potential exposures – whether they are residential or non-residential, and non-residential mostly denotes buildings that house commercial or workplace environments. A "list" of buildings will be compiled including all buildings that volunteer to participate in the survey. Complete participation in this survey is required, meaning that a sufficient number of units within these buildings will be made available for sampling. Only with this level of participation can the survey be characterized as a "building survey" (in contrast to an apartment survey, an office survey, or a different survey with a smaller sampling unit). As discussed below, a procedure to sample numerous "units" within the building will allow for a complete building characterization.

A statistical approach will be used to select a sample from the list of all eligible buildings.

Specifically, a grid will be established over the sampling area. This could be a square grid (a simple square pattern) or a polar grid (concentric circles with radials extending from the center outwards). Nodes (i.e., points of intersection – corners of the square grid or places where the radials intersect the concentric circles) within the grid are randomly selected, and then the building nearest the grid point is selected for sampling. This procedure to select nodes and then buildings is to be determined, but will include the important consideration of selecting in areas of most concern – areas near Ground Zero and other areas where the heaviest deposition is expected to have occurred.

Once sampling begins, prior cleaning histories for each building will be determined. This information can be tied to sampling results as a way of evaluating different cleaning methods.

Figure 1 shows the location of key areas where an EPA analysis determined the extent of deposition of WTC dust and debris, as developed by EPA's Environmental Photographic Interpretation Center (EPIC, 2004). The ground dust/debris boundaries in Figure 1 were derived from the analysis of multiple images taken between September 11 and September 13, 2001. This is the area that EPA believes was most heavily impacted by the dust generated when the towers collapsed. As can be seen in Figure 1, "confirmed dust/debris" areas extend to approximately Chambers Street, "probable dust/debris" areas extend to approximately Canal Street , and "possible dust/debris" areas extend to approximately Spring Street on the West Side near the Holland Tunnel .

Approach to Building Characterization: In order to gain sufficient coverage of each building, one "unit" for every two floors will be sampled. Therefore, taller buildings will receive more representation in the results in terms of numbers of samples. Adjustments may be required to account for location so that buildings with more data do not misrepresent spatial patterns. A "unit" generally denotes a reasonably small, confined, and well defined area that will be different for each building and building type. For example, a unit within a school could be a classroom, within a residential building could be an apartment, and within an office building could be an area including several cubical and private offices. Priority in unit selection will be given to the units closest to Ground Zero – i.e., the ones most nearly facing Ground Zero and to units served by HVAC systems. Two sets of dust samples will be taken within each unit: 1) locations where dust-related exposures are likely to occur, such as in elevated horizontal surfaces (e.g., desk or table tops) and floors, and 2) locations where WTC dust may have accumulated but not necessarily cleaned, such as behind or on top of cabinets. Wipe samples as well as microvac samples will be taken; wipe samples will be taken from non-porous surfaces such as table tops, and microvac samples will be taken on porous surfaces such as rugs or fabric furniture. Enough sample volume will be taken so that contaminant analysis can measure for what are anticipated to be WTC signature contaminants as well as other "contaminants of potential concern" (COPCs; see overview on contaminants sampled below). In addition to dust samples, one or more passive air samples will be taken in each unit, depending on the configuration of the unit. For example, a classroom may need only one passive sample while an apartment may need one sample per room. A "passive" air sample is one in which no agitation for dust suspension is employed, in contrast to modified aggressive or aggressive air sampling. It is noted that agitation is

used in AHERA sampling, but not in other types of indoor sampling conducted for purposes of determining air quality or clearance. The purpose of these samples is twofold: 1) to describe the relationship, if any, between results in dust samples and air samples, and 2) to facilitate health-impact analysis by comparing results from the air samples to inhalation-based health benchmarks. Dust samples will also be compared to appropriate health-related benchmarks, although this comparison to results from dust samples taken in inaccessible areas will be caveated since health-related benchmarks are based on exposures that will not occur in these inaccessible areas. All results of sampling will be shared with the building or apartment owners. If results indicate exceedence of a health-based benchmark, recommendations for cleaning will be made to the owners. An offer to clean the space at no cost to the owner will also be made.

COPCs: Contaminants of potential concern will be measured in both the air and dust samples. They are shown below with their health-related benchmarks:

COPC	Indoor Air Benchmark	Settled Dust Benchmark
Asbestos	0.0009 S/cc	n/a
MMVF	0.01 S/cc	n/a
PAH	0.2 $\mu g/m^3$	150 $\mu g/m^2$
Silica	5 $\mu g/m^3$	n/a

It is important to note that lead and dioxin have been identified as WTC COPCs, but these are not on the list. Lead, which can cause serious learning disabilities and behavioral problems in children, is commonly found in the air, water, soil and indoor dust of the urban environment, and in people's diets. It is often present in older housing that may contain lead-based paint. According to HUD data, about five percent of the housing stock in the Northeast has lead levels above the 25 $\mu g/ft^2$ benchmark. In buildings constructed before 1939, more than 10 percent exceed 25 $\mu g/ft^2$. This factor makes it difficult to distinguish between lead from World Trade Center dust and other sources, especially in older buildings. However, if specific requests are made to analyze samples for lead, such an analysis will be conducted. All findings will be reported to owners, and if elevations are found, owners will be apprised of options for dealing with the finding. It is recommended that dioxin also not be measured in this survey. Like lead, dioxin is a ubiquitous urban contaminant, so attributing dioxin findings to WTC is difficult. Second, dioxin dust sampling during EPA's Clean-Up Program in 2002 found very little dioxin in apartments in the Clean-Up Zone. Of 1538 dust samples taken in 262 apartments, only 8 samples, or 0.5%, showed a level greater than the dust standard developed by Region 2 of 2 ng/m^2. The single high outlier of 75 ng/m^2 was found on a mantel over a fireplace, and given that dioxins are a product of incomplete combustion, to find this elevated level above a fireplace is not unexpected.

The WTC signature concurrent effort (discussed below) is currently targeting MMVF and PAHs as possible signature compounds to identify WTC dust and WTC fire by-products, respectively. Analysis of the samples for the above-mentioned COPCs will likely proceed before the WTC signature workgroup is able to complete their validation study. Before any samples are taken, however, the workgroup will provide information on the necessary sample volume and analytical methods which will allow for the measurement of the dust and air

samples for the signature compounds with an appropriate level of detection.

HVAC sampling: In order to characterize central HVAC units in buildings which have full or partial central HVAC units ("full" defined as units serving both common areas and individual apartments, offices, etc; while "partial" is defined as units serving only common areas while apartments or offices have individual units), microvac samples will be taken in: 1) outdoor air inlet to HVAC, 2) downstream of air filters, 3) air mixing plenums serving sampled floors, and 4) HVAC outlet discharging to locations where COPC samples are taken. While all samples may be informative with regard to WTC impact, it is expected that the last noted sample location, where the HVAC discharges to where COPC samples are taken, may be the most informative with regard to elucidating the role HVAC systems have on recirculating WTC contaminants to exposure areas.

Data analysis: The data collected will be used to estimate the number, proportion, and location of buildings: 1) where measurements of COPCs exceed health based bench marks; and 2) where measurements indicate the presence of WTC signature dust. Results will be categorized according to location such as by district 1, 2 and 3 and distance of sampling node from the WTC site. The critical requirement is that the design should support assessment of the effect of geographic factors on the presence and levels of the measurements.

WTC Signature Validation

Overview: Samples of settled WTC dust taken outside within the first few weeks after September 11, 2001, and near Ground Zero, have suggested a WTC collapse related "signature" associated with slag wool. Also, samples of dust and air taken outside suggest a combustion (or fire) related signature associated with polycyclic aromatic hydrocarbons (PAHs). It is hypothesized that dust which settled near Ground Zero shortly after September 11 would contain this WTC collapse related slag wool signature whereas depositions further away geographically and also which may have occurred later in time when the collapse dust was no longer settling would more likely have the fire-related signature. While these "signatures" have been described for outdoor measurements, only a very limited number of indoor samples have been analyzed. The principal purposes of the validation process include: 1) elaborate on the specifics of the dust and fire-related signature profiles, 2) further develop and test analytical methods that can identify these signatures in dust at a sufficient level of detection, 3) determine conclusively whether dust containing this signature also entered the indoor environment.

Approach: Archived samples from EPA indoor testing of impacted apartments, and from other monitoring or indoor testing programs, will be retrieved and analyzed for the presence of these signatures. This will be useful for determining whether dust containing the signature in fact entered the indoor environment. Filters from air samples taken indoors in these impacted apartments will also be retrieved and analyzed. Not only will these archived dust and filter samples be analyzed for the signature contaminants, but also for the other COPCs identified above. The purpose of sampling for other COPCs is to assess relationships among the contaminants, that is, is the presence of the WTC signature

correlated with elevated levels of other COPCs identified above? As important as confirming the presence of the WTC signature in apartments known to be impacted by WTC, is confirmation of the absence of the WTC signature in background apartments. Archived samples from EPA's background study conducted at the time may be retrieved and analyzed at this time, for this purpose. These archived samples, however, are only air samples. Dust samples taken at the time in background samples, perhaps the apartment study conducted by NYCDOHMH/ATSDR (2002) could be retrieved. Lacking archived samples, samples could be taken at the present time to confirm that dust and air in distant apartments do not contain the signature.

References

EPIC, 2004. Mapping the Spatial Extent of Ground Dust and Debris from the Collapse of the World Trade Center Buildings. Jennings, D.G., D. J. Williams, and D. Garofalo, authors. Environmental Photographic Interpretation Center, Landscape Ecology Branch, Environmental Sciences Division, National Exposure Research Laboratory, Office of Research and Development, US EPA. Reston, VA 20192. DRAFT July 2004.

NYCDOHMH/ATSDR. (2002) New York Department of Health and Mental Hygiene and Agency for Toxic Substances and Disease Registry. Final Technical Report of the Public Health Investigation To Assess Potential Exposures to Airborne and Settled Surface Dust In Residential Areas of Lower Manhattan. Agency for Toxic Substances and Disease Registry, US Department of Health and Human Services, Atlanta, GA.

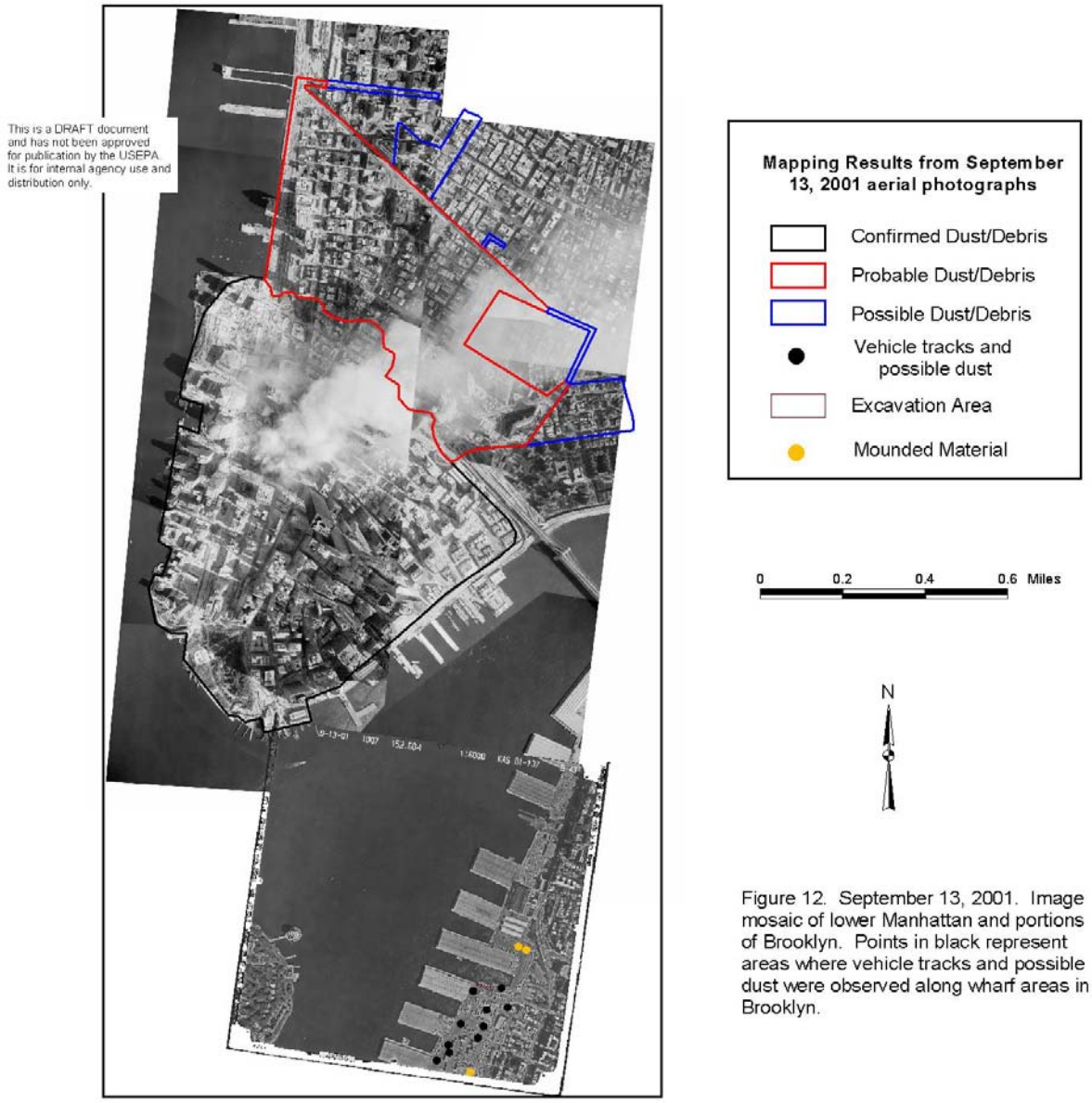

Figure 12. September 13, 2001. Image mosaic of lower Manhattan and portions of Brooklyn. Points in black represent areas where vehicle tracks and possible dust were observed along wharf areas in Brooklyn.

Figure 1. Display of boundaries of expected deposition based on analysis conducted by EPA's Environmental Photographic Interpretation Center (EPIC, 2004).